

UNCLASSIFIED

AD NUMBER	
AD035575	
CLASSIFICATION CHANGES	
TO:	unclassified
FROM:	restricted
LIMITATION CHANGES	
TO:	Approved for public release, distribution unlimited
FROM:	Distribution authorized to U.S. Gov't. agencies and their contractors; Administrative/Operational Use; 03 DEC 1953. Other requests shall be referred to Naval Proving Ground, Dahlgren, VA.
AUTHORITY	
USNSWC ltr, 10 Jul 1975; USNSWC ltr, 10 Jul 1975	

THIS PAGE IS UNCLASSIFIED

# Armed Services Technical Information Agency

Because of our limited supply, you are requested to return this copy WHEN IT HAS SERVED YOUR PURPOSE so that it may be made available to other requesters. Your cooperation will be appreciated.

# AD

# 35575

**NOTICE: WHEN GOVERNMENT OR OTHER DRAWINGS, SPECIFICATIONS OR OTHER DATA ARE USED FOR ANY PURPOSE OTHER THAN IN CONNECTION WITH A DEFINITELY RELATED GOVERNMENT PROCUREMENT OPERATION, THE U. S. GOVERNMENT THEREBY INCURS NO RESPONSIBILITY, NOR ANY OBLIGATION WHATSOEVER; AND THE FACT THAT THE GOVERNMENT MAY HAVE FORMULATED, FURNISHED, OR IN ANY WAY SUPPLIED THE SAID DRAWINGS, SPECIFICATIONS, OR OTHER DATA IS NOT TO BE REGARDED BY IMPLICATION OR OTHERWISE AS IN ANY MANNER LICENSING THE HOLDER OR ANY OTHER PERSON OR CORPORATION, OR CONVEYING ANY RIGHTS OR PERMISSION TO MANUFACTURE, USE OR SELL ANY PATENTED INVENTION THAT MAY IN ANY WAY BE RELATED THERETO.**

**Reproduced by**  
**DOCUMENT SERVICE CENTER**  
**KNOTT BUILDING, DAYTON, 2, OHIO**

UNCLASSIFIED

U. S. NAVAL PROVING GROUND  
DAHLGREN, VIRGINIA

REPORT NO. 1208

20MM AIRCRAFT GUNS, AN-M3 AND AN-M24  
EXPERIMENTAL AND DEVELOPMENTAL TESTS

12th Partial Report

-----  
20MM AMMUNITION ASSIST FEEDER  
DEVELOPED BY HARVEY MACHINE CO.

FINAL Report

Copy No. \_\_\_\_\_

Task

Assignment HPG-Resg-108-20-82

Classification RESTRICTED  
SECURITY INFORMATION

UNCLASSIFIED

UNCLASSIFIED

NPO REPORT NO. 1208

**20mm Ammunition Assist Feeder  
Developed by Harvey Machine Company**

-----

**PART A**

**SYNOPSIS**

1. This report covers the evaluation of a Harvey Assist Feeder in conjunction with 20mm aircraft gun Mk 16 as suggested by reference (b). The salient features that were to be designed into the mechanism are outlined as follows:

a. Supplies ammunition to gun feeder at essentially zero belt load regardless of belt pull between ammunition box and booster. This increases the reliability and possibly the average rate of fire.

b. Reduces "belt whip" by providing 1 1/2 rounds which can be withdrawn from the reservoir without any movement of the belt at the beginning of a burst. This reservoir action also cushions the stopping of the belt.

c. Prevents starving of gun during single shot or short burst operation (a condition which occurs in ammunition systems using ordinary booster).

d. Prevents overfeeding of gun through quick release action of single plate type magnetic clutch and "cushion" effect of reservoir.

e. Greatly reduces maximum current drain during starting under load, through unique idling system.

2. On basis of the results it is concluded that:

a. The Harvey Assist Feeder did not perform the task that it is designed to do, at least, not in conjunction with the 20mm aircraft gun Mk 16. Insufficient tests were conducted to definitely establish its performance in conjunction with the 20mm aircraft gun AN-M3.

b. No definite conclusions can be drawn concerning the location of defects in the design of booster since a completely satisfactory operation was never obtained. The tests were terminated after the anti-roll back ratchet wheel had failed.

UNCLASSIFIED

~~RESTRICTED~~  
~~SECURITY INFORMATION~~

~~RESTRICTED~~

NPG REPORT NO. 1208

20mm Ammunition Assist Feeder  
Developed by Harvey Machine Company

-----

TABLE OF CONTENTS

	<u>Page</u>
SYNOPSIS. . . . .	1
TABLE OF CONTENTS . . . . .	2
AUTHORITY . . . . .	3
REFERENCES. . . . .	3
OBJECT OF TEST. . . . .	3
PERIOD OF TEST. . . . .	3
DESCRIPTION OF ITEM UNDER TEST. . . . .	4
DESCRIPTION OF TEST EQUIPMENT . . . . .	5
PROCEDURE . . . . .	5
RESULTS AND DISCUSSION. . . . .	6
CONCLUSIONS . . . . .	7
APPENDIX A - TABULATED FIRING DATA. . . . .	1-7 (Incl)
APPENDIX B - NPG PHOTOGRAPHS. . . . .	FIGURES 1-7 (Incl)
APPENDIX C - DISTRIBUTION . . . . .	1-2 (Incl)

**RESTRICTED**

**NPG REPORT NO. 1208**

**20mm Ammunition Assist Feeder  
Developed by Harvey Machine Company**

-----

**PART B**

**INTRODUCTION**

**1. AUTHORITY:**

Reference (a) established Task Assignment NPG-Re8a-20-52 for experimental investigations and developmental tests of the 20mm aircraft guns AN-M3 and M24. This was amended by reference (b) to include the evaluation of the 20mm Harvey Assist feed mechanism.

**2. REFERENCES:**

- a. BUORD Rest ltr NPG Re8a-JOwmts of 20 Sept 1951
- b. BUORD Rest ltr NPG Re8a-CFWmts of 8 Feb 1952

**3. OBJECT OF TEST:**

The object of this evaluation was to determine the suitability of the Harvey Assist Feeder for use with 20mm aircraft guns AN-M3 and M24 and their associated feed mechanisms.

**4. PERIOD OF TEST:**

- |                                     |                 |
|-------------------------------------|-----------------|
| a. Date of Project Letter           | 8 February 1952 |
| b. Date Necessary Material Received | 29 January 1952 |
| c. Date Test Commenced              | 29 January 1952 |
| d. Date Test Completed              | 11 March 1952   |

**RESTRICTED  
SECURITY INFORMATION**

RESTRICTED

NPG REPORT NO. 1208

20mm Ammunition Assist Feeder  
Developed by Harvey Machine Company

-----

PART C

DETAILS OF TEST

5. DESCRIPTION OF ITEM UNDER TEST:

The Harvey Assist Feeder or Booster, shown in Figures 2 and 3, is designed to assist the feeding of the ammunition to the gun on the demand of the gun feed mechanism. This feeding action is accomplished by a 24 volt D.C. motor geared to a sprocket wheel through planetary reduction gears. The booster incorporates a single plate-type magnetic clutch and an ammunition reservoir having one and one half rounds capacity. A quick release action in the magnetic clutch is designed to prevent overfeeding of the gun feed mechanism. The electric motor in the booster idles at half speed when the gun arming switch is closed and the ammunition reservoir is filled with ammunition. This reduces the electric current required at the beginning of a burst and permits quicker acceleration of the sprocket wheel. When the gun feed mechanism pulls on the ammunition belt the magnetic clutch switch is actuated and the clutch is engaged. The sprocket then assists in feeding ammunition to the gun as long as the clutch is engaged. The sprocket wheel free wheels at 135 rpm and has nine sprockets. When the firing switch is released, the booster continues to feed until the ammunition belt depresses the clutch switch which in turn disengages the sprocket wheel from the motor. The motor resumes half speed operation until either the gun is fired again or the arming switch is turned off. To remove the ammunition belt from the booster in a direction opposite to feed, it is necessary to release the anti-roll back device in the motor. This is done by rotating the depressed slotted pin located in one end of the motor.

RESTRICTED

NPO REPORT NO. 1208

20mm Ammunition Assist Feeder  
Developed by Harvey Machine Company

-----

6. DESCRIPTION OF TEST EQUIPMENT:

a. The following test equipment was used for the evaluation of the booster:

- (1) Batteries and a generator as a source for direct current electricity.
- (2) 20mm aircraft guns Mk 16 and AN-M3.
- (3) 20mm feed mechanisms Mk 8 Mod 0 and AN-M2.
- (4) Rigid box type gun mounts.
- (5) Two pieces of ammunition chuting each 3 feet long and a wooden ammunition box.
- (6) High speed movie camera, 35mm.
- (7) 20mm ammunition links MSEI made by L. A. Young and Company.
- (8) Heiland Recording Oscillograph.
- (9) 20mm Ammunition, M90 series - 3745 rounds.

b. A photograph of the test setup is shown in Figure (1).

7. PROCEDURE:

A standard 20mm aircraft gun Mk 16 was used in the major portion of the evaluation. Various length bursts, both continuous and interrupted, up to 270 rounds were fired at ambient temperatures. The booster, energized by 27 volts D.C. from either batteries or generated power, was located approximately midway between the ammunition box and the gun feed mechanism. About three feet of ammunition chuting was attached to each end of the booster. The chuting was fixed rigidly on a wooden platform. For portions of the tests the voltage to the booster was changed to as high as 31 volts since it was suspected that the motor speed during feeding was not high enough to keep the gun feed mechanism supplied with ammunition. Also, the action of belt motion in the booster was studied by high speed motion pictures. The action of the clutch switch as well as the current and voltage supplied to booster motor were recorded by a Heiland Recording Oscillograph.

RESTRICTED  
SECURITY INFORMATION

20mm Ammunition Assist Feeder  
Developed by Harvey Machine Company

-----

## 8. RESULTS AND DISCUSSION:

Complete detailed results are included as Appendix (A). The results show that the booster does not supply ammunition at the rate required by a 20mm aircraft gun Mk 16 as is evidenced by failures to feed, link deformations on the outboard side of the gun feed mechanism belt retaining pawls, and belt separations between the gun feed mechanism and the booster. Only 19 of 64 attempts, exclusive of belt pull tests and stoppages from other causes, were successfully fired out. The tests were terminated because of the failure of the anti-roll back ratchet wheel in the booster before it was established whether this inability to maintain adequate ammunition supply was caused by the faster firing rate of 20mm aircraft gun Mk 16 (about 790 rpm as compared to 740 rpm using an AN-M3 gun) or by the more severe nature on belt motion of intermittent reciprocating feeding action of the Mk 8 feed mechanism as compared to more uniform flow of ammunition in the rotary action of the AN-M2 feed mechanism. Each of the three firing attempts made with a 20mm aircraft gun AN-M3 was a successful fireout. Even though the failures to feed cannot all be blamed on the booster, about one third of the failures to feed were accompanied by stretched links. This would indicate that a sizeable ratio of the failures to feed were directly chargeable to the booster. The motion pictures showed that there was considerable tension applied intermittently to the ammunition belt as it passes through the booster. A sequence of events taken from the motion pictures is included as Figure 6. The oscillograms showed that the clutch switch is open about 3/7 of the gun firing cycle, but that the clutch rarely disengages. It is seen from Figure 5 that the clutch pull-in is very rapid, about the order of 1 millisecond, but that the drop out is in excess of 50 milliseconds. The disturbances noted by both the voltage and current element in the motor circuit is apparently caused by surge of current drawn by the magnetic clutch slipping because of lubricants or other foreign materials on the faces of the plates. This was obviated by thoroughly cleaning them twice during the tests. While somewhat improved operation was obtained after the second cleaning, the belt separation and failures to feed were not entirely eliminated. The results appear anomalous, however, in that one form of gun feed malfunction which had been prevalent in previous firings of Mk 8 feed mechanisms using the same links was not noted in these tests. The double loops of the belt link deformed toward each other sufficiently permitting the link to ride off the stripper. The link would tend to follow the round into the feed throat causing a gun stoppage. Those links had a Rockwell C-38 hardness which is within the limits specified by

RESTRICTED

NPG REPORT NO. 1208

20mm Ammunition Assist Feeder  
Developed by Harvey Machine Company

-----

BUORD Dwg. 7238242. It was later found that links having Rockwell C-46 would function satisfactorily in the 20mm feed mechanism Mk 8. The motor load current and voltage was an average about 11 amperes and 23 volts D.C. The transient current at the beginning of a burst is approximately as high as 65 amperes under normal starting conditions without any extraneous load applied to the belt. The transient period is about 85 milliseconds under the same conditions.

PART D

CONCLUSIONS

9. On basis of the results it is concluded that:

a. The Harvey Assist Feeder did not perform the task that it is designed to do, at least, not in conjunction with the 20mm aircraft gun Mk 16. Insufficient tests were conducted to definitely establish its performance in conjunction with the 20mm aircraft gun AN-M3.

b. No definite conclusions can be drawn concerning the location of defects in the design of booster since completely satisfactory operation was never obtained. The tests were terminated after the anti-roll back ratchet wheel had failed.

UNCLASSIFIED

UNCLASSIFIED  
RESTRICTED  
SECURITY INFORMATION

RESTRICTED

NPG REPORT NO. 1208

20mm Ammunition Assist Feeder  
Developed by Harvey Machine Company

-----

The investigation upon which this report is based was conducted by:  
J. V. BLANTON, Accessories and Ammunition Development Branch  
Aircraft Armament Division  
Aviation Ordnance Department

This report was prepared by:  
JOHN PINKER, JR., Head Engineer,  
Aircraft Armament Division  
Aviation Ordnance Department

This report was reviewed by:  
L. D. RUCKER, Lieutenant Commander, USNR  
Aircraft Armament Officer  
Aviation Ordnance Department  
J. C. TALLEY, Director of Research  
Aviation Ordnance Department  
F. A. NUSOM, Captain, USN  
Aviation Ordnance Officer  
Aviation Ordnance Department  
C. C. BRAMBLE, Director of Research, Ordnance Group

APPROVED: J. F. BYRNE  
Captain, USN  
Commander, Naval Proving Ground



E. A. RUCKNER  
Captain, USN  
Ordnance Officer  
By direction

UNCLASSIFIED  
RESTRICTED  
SECURITY INFORMATION

UNCLASSIFIED

~~RESTRICTED~~

UNCLASSIFIED

NPO REPORT NO. 1208

U. S. NAVAL PROVING GROUND  
DAHLGREN, VIRGINIA

Twelfth Partial Report

on

20mm Aircraft Guns, AN-M3 and AN-M24

Experimental and Developmental Tests

-----

Final Report

on

20mm Ammunition Assist Feeder

Developed by Harvey Machine Company

Classification cancelled in accordance with  
Executive Order 12958, dated May 1953

*J. D. B. L.*  
*8/4/54*

Naval Ordnance Station Center  
Naval Ordnance Station Agency

Project No.: NPO-Re8a-108-20-52  
No. of Pages: 8

Date: DEC 3-1953

~~RESTRICTED~~  
~~UNCLASSIFIED~~

UNCLASSIFIED

UNCLASSIFIED

20mm Ammunition Asst. Powder Developed by Harvey Machine Company

200 REPORT NO. 1200

PERMUTED FIFTH DATA

20mm Aircraft Gun, No 10 Serial Number 0100

Date	In Pals	Rounds Fired	Total Rounds on Gun	Capable Rounds (875)	Total Rounds on Gun	Powder Air Pressure (PSI)	Survey Ammunition Bombs	Killing Voltage V.D.C.	Killing Current Amps	Surge Voltage V.D.C.	Surge Current Amps	Operating Voltage V.D.C.	Operating Current Amps	Average Time		Remarks
														Clicks	Clicks	
2-1-52																
2-1-52	230	20	5439	768	180	800	24	-	-	-	-	-	-	-	-	Bombs started high on Ouder and plate.
2-1-52	221	167	5608	768	347	800	148	-	-	-	-	-	-	-	-	Same as last burst.
2-1-52	52	52	5608	-	389	800	245	-	-	-	-	-	-	-	-	Fired not satisfactorily.
2-1-52	250	30	5656	768	437	800	228	-	-	-	-	-	-	-	-	Failure to feed. Bomb not done in time to be observed by ball.
2-1-52	212	16	5711	767	433	800	216	-	-	-	-	-	-	-	-	Failure to feed. Single loop of link stretched very badly.
2-1-52	197	19	5790	768	471	800	217	-	-	-	-	-	-	-	-	Same as last burst.
2-2-52	200	2	1548	-	2317	800	219	-	-	-	-	-	-	-	-	Coiled round in feeder.
2-2-52	198	6	1561	719	2318	800	226	-	-	-	-	-	-	-	-	Same as last burst.
2-2-52	182	10	1561	720	2313	800	236	-	-	-	-	-	-	-	-	Bomb failed to get done in time. Single loop of link from last round fired straight very badly.
2-2-52	182	16	1576	-	2348	800	240	-	-	-	-	-	-	-	-	Same as last burst.
2-2-52	35	20	1596	768	2368	800	240	-	-	-	-	-	-	-	-	Ammunition bumper not used for this burst only. Bait rule under round.
2-2-52	107	107	1703	772	2478	800	437	-	-	-	-	-	-	-	-	Fired not satisfactorily.
2-2-52	280	53	1786	764	2187	800	509	-	-	-	-	-	-	-	-	Bait separation. Single loop of link or last round fired distorted very badly.
2-2-52	210	186	1923	770	2723	800	707	-	-	-	-	-	-	-	-	Bomb failed to get done in time.
2-2-52	260	35	1980	770	2780	800	742	-	-	-	-	-	-	-	-	Failure to feed. Bomb not done in time to be observed by ball.
2-2-52	215	149	2137	770	2808	800	891	-	-	-	-	-	-	-	-	Same as last burst.
2-3-52																

REPLACED WITH 200 2248 (1248 BOUNDS). RE. 2-0 FEEDER EL-11 (471 BOUNDS) REPLACED WITH EL-10 (2115 BOUNDS) WHICH WAS CHANGED FROM R.L. TO L.R.

FEEDER FLOOR FROM EL-3 CHANGED WITH FEEDER INTO EL-10.

APPENDIX A

UNCLASSIFIED

RESTRICTED

Eaton Ammunition Limited Powder Developed by Harvey Machine Company

EVO REPORT NO. 1208

## TABLED FIRM DATA (Continued)

Eaton Aircraft Co., 10 10 Serial Number 2202

Date	Rounds in Bin	Rounds Fired	Total Rounds on Gun	Cyclic Rate (RPM)	Total Rounds on Powder	Powder Air Pressure (PSI)	Survey Ammunition Total Rounds	Milling V.D.C. RPM	Milling Current V.D.C.	Surge V.D.C. RPM	Surge Current V.D.C.	Peak Surge Current V.D.C.	Operating Voltage Current V.D.C.	Operating Current V.D.C.	Average Time		Remarks
															Micro-Seconds Standard (MilliSecs)	Micro-Seconds Open (MilliSecs)	
2-6-52	250	92	2219	773	3001	800	992	-	-	-	-	-	-	-	-	-	Small value about to imminent position alluding air to escape from gun chamber. Gun on last level.
2-5-52	150	61	2180	773	3002	800	1004	-	-	-	-	-	-	-	-	-	Gun on last level.
2-5-52	132	26	2318	748	3003	800	1002	-	-	-	-	-	-	-	-	-	Gun on last level.
2-5-52	108	22	2356	773	3110	800	1002	-	-	-	-	-	-	-	-	-	Gun on last level.
2-5-52	270	270	2608	773	3380	800	1002	-	-	-	-	-	-	-	-	-	Gun on last level.
2-13-52	32	32	2640	-	3412	800	1004	-	-	-	-	-	-	-	-	-	Gun on last level.
2-13-52	33	33	2378	-	3440	800	1007	-	-	-	-	-	-	-	-	-	Gun on last level.
2-13-52	215	16	2682	-	3460	800	1003	-	-	-	-	-	-	-	-	-	Gun on last level.
2-13-52	203	98	2771	-	337	800	1005	-	-	-	-	-	-	-	-	-	Gun on last level.
2-13-52	120	24	2306	-	341	800	1006	-	-	-	-	-	-	-	-	-	Gun on last level.
2-13-52	86	10	2815	-	371	800	1009	-	-	-	-	-	-	-	-	-	Gun on last level.
2-13-52	76	9	2824	-	380	800	1078	-	-	-	-	-	-	-	-	-	Gun on last level.
2-14-52	100	5	2879	-	328	800	1008	-	-	-	-	-	-	-	-	-	Gun on last level.
2-15-52	128	9	2828	700	316	800	1008	-	-	-	-	-	-	-	-	-	Gun on last level.
2-15-52	118	25	2806	704	440	800	1005	-	-	-	-	-	-	-	-	-	Gun on last level.
2-15-52	88	31	3018	771	471	800	1009	-	-	-	-	-	-	-	-	-	Gun on last level.
2-15-52	107	24	2909	771	486	800	1005	-	-	-	-	-	-	-	-	-	Gun on last level.
2-15-52	200	24	2908	773	319	800	1717	-	-	-	-	-	-	-	-	-	Gun on last level.
2-15-52	280	29	2908	-	348	800	1746	-	-	-	-	-	-	-	-	-	Gun on last level.
2-15-52	281	5	2807	-	343	800	1741	-	-	-	-	-	-	-	-	-	Gun on last level.
2-15-52	216	123	3130	773	686	800	1006	-	-	-	-	-	-	-	-	-	Gun on last level.

RESTRICTED  
SECURITY INFORMATION

**Amateur writers looking for published work (priority will be given to those who are currently employed by the federal government)**

**MAILED 1000 JUL 10 1964 (C-21-1-1004)**

**John Alcorn's Co., 1st IS Caval Bn, 1st Div**

Date	Rounds in Belt Fired	Total Rounds on Gun	Total Oxalic Acid Rate (grs)	Total Acids in Podder	Podder Air Pressure (psi)	Survey Boulder Total Boulds	Filling Volume V.D.C.	Milling Current amp	Sieve Volume V.D.C.	Sieve Current amp	Peak Sieve Current amp	Operating Volume V.D.C.	Operating Current amp	Average Time	
														Micro-Switch Closed (minutes)	Micro-Switch Open (minutes)
2-2-42	260	3160	-	708	600	1800	-	8	18	40	-	28	11	89	80
2-16-42	260	3160	-	708	600	1806	-	-	-	-	-	-	-	-	-
2-16-42	266	3167	-	716	600	1811	-	-	-	-	-	-	-	-	-
2-16-42	219	2801	-	708	600	1806	-	-	-	-	-	-	-	-	-
2-16-42	219	2801	-	707	600	1806	-	-	-	-	-	-	-	-	-
2-16-42	185	2317	-	718	600	1808	-	-	-	-	-	-	-	-	-
2-16-42	159	2023	-	718	600	1808	-	-	-	-	-	-	-	-	-
2-16-42	153	1812	-	708	600	1807	-	-	-	-	-	-	-	-	-
2-26-42	200	2526	-	106	600	1801	-	-	-	-	-	-	-	-	-
2-26-42	186	2341	-	791	600	1878	-	-	-	-	-	-	-	-	-
2-26-42	181	2216	-	688	600	1879	-	-	-	-	-	-	-	-	-
2-26-42	178	2077	-	128	610	1808	-	-	-	-	-	-	-	-	-
2-26-42	17	571	-	798	610	1808	-	-	-	-	-	-	-	-	-
2-26-42	80	1801	-	798	610	1808	-	-	-	-	-	-	-	-	-
2-26-42	108	1606	-	688	600	1808	-	-	-	-	-	-	-	-	-
2-26-42	189	2600	-	128	600	1808	-	-	-	-	-	-	-	-	-
2-26-42	168	2400	-	994	600	1807	-	-	-	-	-	-	-	-	-

Single inspection at Boulder belt holding position. Single loop of link on last round fired stretched very badly.

Wallops on boulder related to 18 v D.C. Gun stoppage same as above.

Same as above.

Section guarder power. Same as above.

Boulder taken out of circuit. Fired out satisfactorily.

11 v D.C. input to bumper heater. Bumper failed to get down in time to be taken down by belt.

Same as above.

18 link in belt - both were observed coming on stoppage - knocking block crushed behind ears (222 rounds) replaced with standard 18 link. The survey bumper was disassembled and clutch plates cleaned.

On disassembly of bumper EL-7 for routine cleaning the following components broken; (1) bumper members, clutch crushing and clutch stop plate badly battered. Bumper EL-18 scratched.

11 v D.C. from batteries applied to bumper. Single loop of link on last round fired stretched very badly.

18 v D.C. applied to bumper from batteries - same stoppage as above.

11 v D.C. applied to bumper from batteries. Bumper had an empty chamber. Based on top of belt.

Same as above.

Survey bumper not used this hour. Belt was empty. Based on top of belt.

Boulder not used this hour.

Wallops reduced to 18 v D.C. Gun replaced several times. Fired out satisfactorily.

Single loop of link stretched very badly.

Belt rode under round.

**1**

**VALUATED / INFO DATA (Contd-mul)**

Home Aircraft Co., Inc. 18 Serial Number 1111

[illegible]

# i

**RELATED FIELD DATA (Continued)**

Don Albrecht, 4th 16 Barfoot Road, 27048

THE UNIVERSITY OF CHICAGO PRESS

## STUDY A

**RESTRICTED  
SECURITY INFORMATION**

RESTRICTED

20mm Ammunition Anti-Air Powder Developed by Harvey Machine Company

WFO REPORT NO. 1208

TABULATED FIRING DATA (Continued)

20mm Aircraft Gun, M2 16 Serial Number 22285

Date	Rounds in Bolt	Total Rounds on Gun	Cycles Rate (RPM)	Total Rounds Fired	Harvey Ammunition Booster Total Rounds	Milling Voltage V.D.C.	Milling Current AMP	Surge Voltage V.D.C.	Surge Current AMP	Peak Surge Current AMP	Operating Voltage V.D.C.	Operating Current AMP	Average Time Click Micro-Seconds Closed	Average Time Click Micro-Seconds Open	Remarks
3-5-52	106	13	767	-	1067	7	6	17	88	91	11	11	68	23	Link stand in bolt of M21 linker. Both link and link observed off allowing round and link to drop down between strippers. On stoppage due to empty round in bolt. In addition to the 46 rounds in the feed tray, a 20 pound bolt lead was applied to the ammunition belt. Substantial gas stoppage.
3-5-52	153	83	4910	791	1575	-	-	-	-	-	-	-	-	-	Link stand in bolt of M21 linker. Both link and link observed off allowing round and link to drop down between strippers. On stoppage due to empty round in bolt.
3-8-52	64	50	4860	787	1225	6	7	17	87	88	16	16	68	21	In addition to the 46 rounds in the feed tray, a 20 pound bolt lead was applied to the ammunition belt. Substantial gas stoppage.
3-9-52	64	7	4817	-	1622	6	8	17	68	51	21	21	41	20	Bolt not home empty. Single loop of link on last round fired stretched very badly. 20 pound bolt lead applied to ammunition belt.
3-8-52	57	6	4881	-	1326	-	-	-	-	-	-	-	-	-	20 pound bolt lead applied to ammunition belt. Failure to eject. Striker and exterior spring broken. Single loop of link on last round fired stretched very badly.
3-9-52	64	25	4888	781	1521	7	6	16	86	21	17	17	42	21	Substantial gas stoppage. On replenished two times. Anti-recoil lock device in Harvey booster broken. 20 pound bolt lead applied to ammunition belt.
3-8-52	64	4	4890	-	1653	8	6	16	88	21	12	12	40	20	Bolt lead increased to 75 pounds. On fail- ure due to failure of anti-recoil lock device mentioned above.
3-11-52	64	6	4896	-	1639	8	6	16	68	21	17	17	-	-	75 pound bolt lead. Badly stretched single loop of link on last round fired. Bolt operation on booster side of "under bolt holding pin".
2-11-52	60	3	4897	-	1772	8	8	16	66	22	19	19	-	-	Same as last burst.
2-11-52	64	8	5003	-	1777	10	8	16	48	22	19	19	-	-	Same as last burst.
2-11-52	18	3	5008	-	1830	-	-	-	60	20	20	20	-	-	Same as last burst.
2-11-52	64	4	4008	-	1834	10	8	16	47	22	19	19	23	23	Same as last burst.
2-11-52	60	11	5030	784	1828	11	8	20	47	22	19	19	23	23	Under detritus valve stuck in innermost position allowing air to escape. 75 pound bolt lead.

RESTRICTED  
SECURITY INFORMATION

**THE UNIVERSITY OF**

© 1997 American Psychological Association

2000-11-01 10:00 AM

[illegible]

**1**

NP9 49727

Mr 16 20mm Gun, -Lx S/Mod 0 Gun Feed Mechanism, Harvey Assist Feeder, Ammunition  
Box and Mitchell Movie Camera.

Figure 1

RESTRICTED

SECURITY INFORMATION

APPENDIX B



UNCLASSIFIED

DIRECTION OF FEED



FIRST LOOP

20MM AMMO FEEDER

TOP VIEW

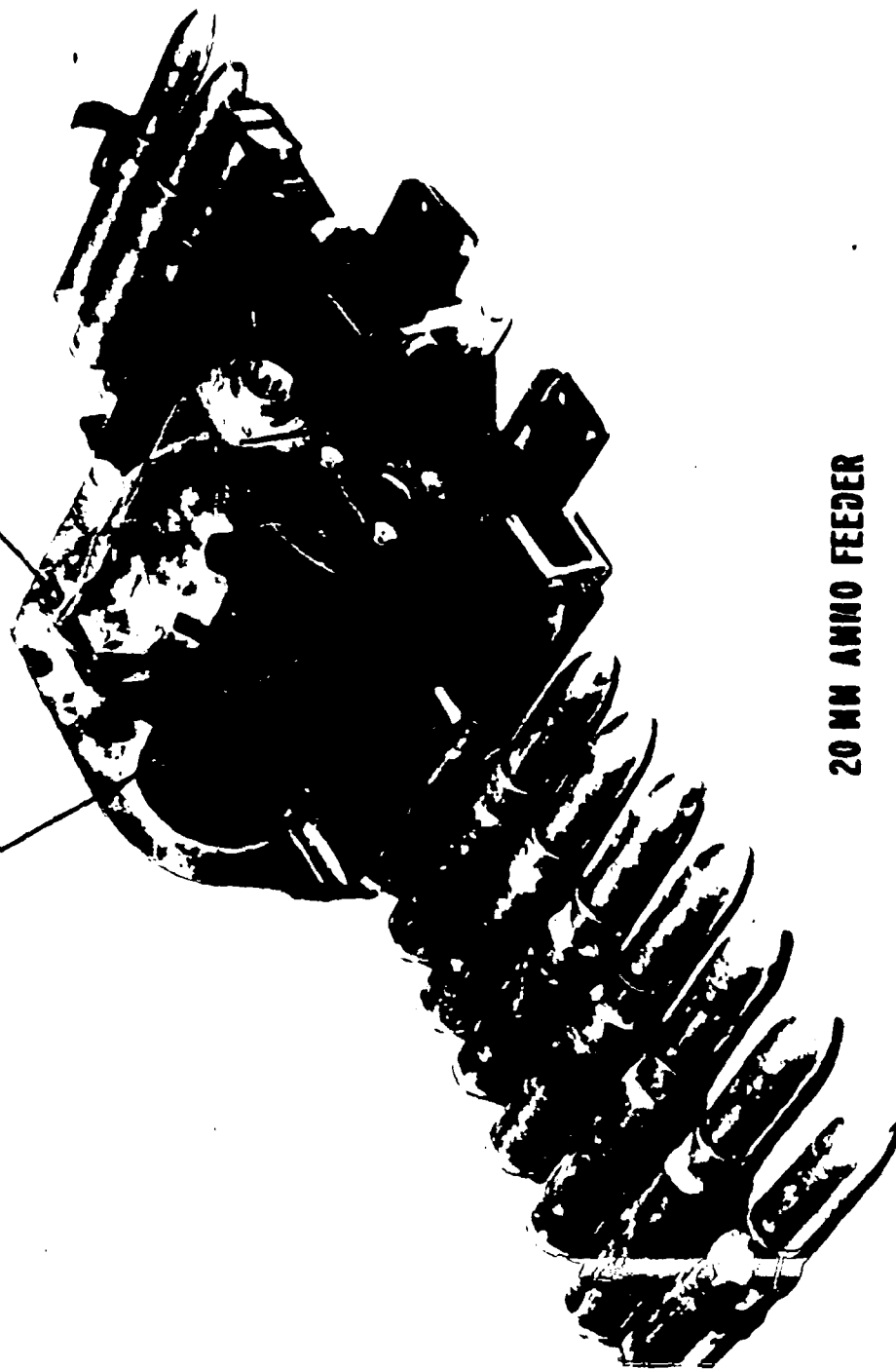
ANTI-DOLLBACK  
RELEASE

UNCLASSIFIED

REF 49704  
100th Heavy Assault Bn

BOOSTER MOTOR

CLUTCH SWITCH

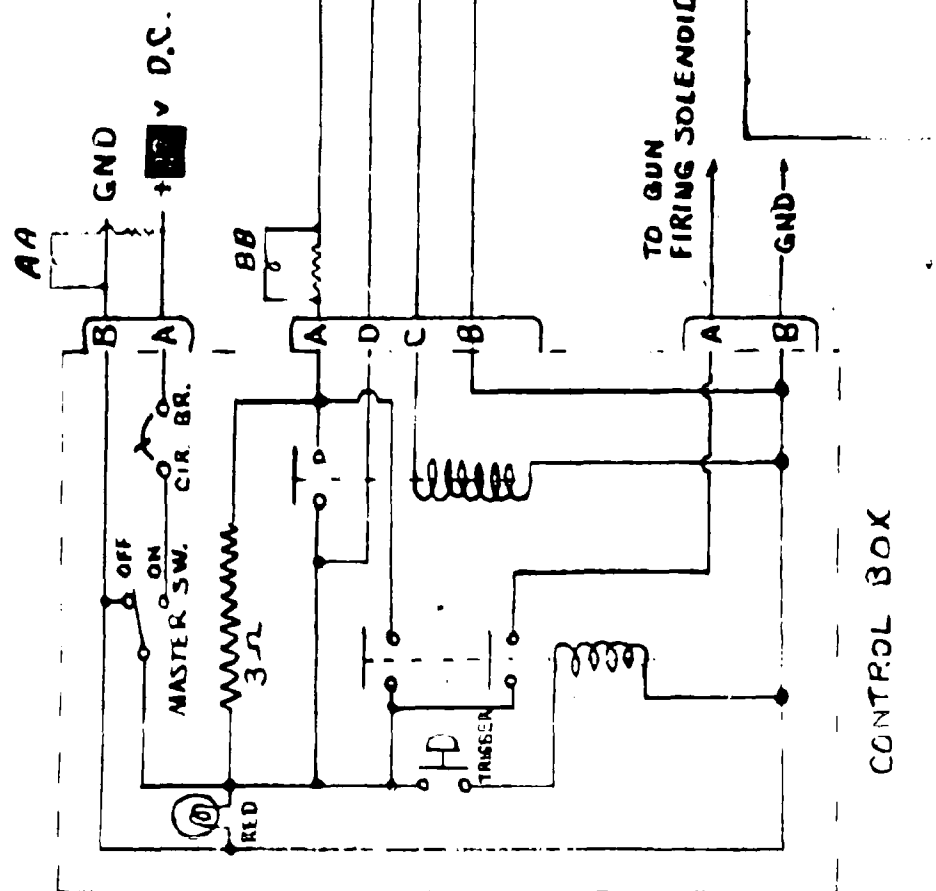


20 MM AMMO FEEDER

BOTTOM VIEW

UNCLASSIFIED

RESTRICTED  
SECURITY INFORMATION

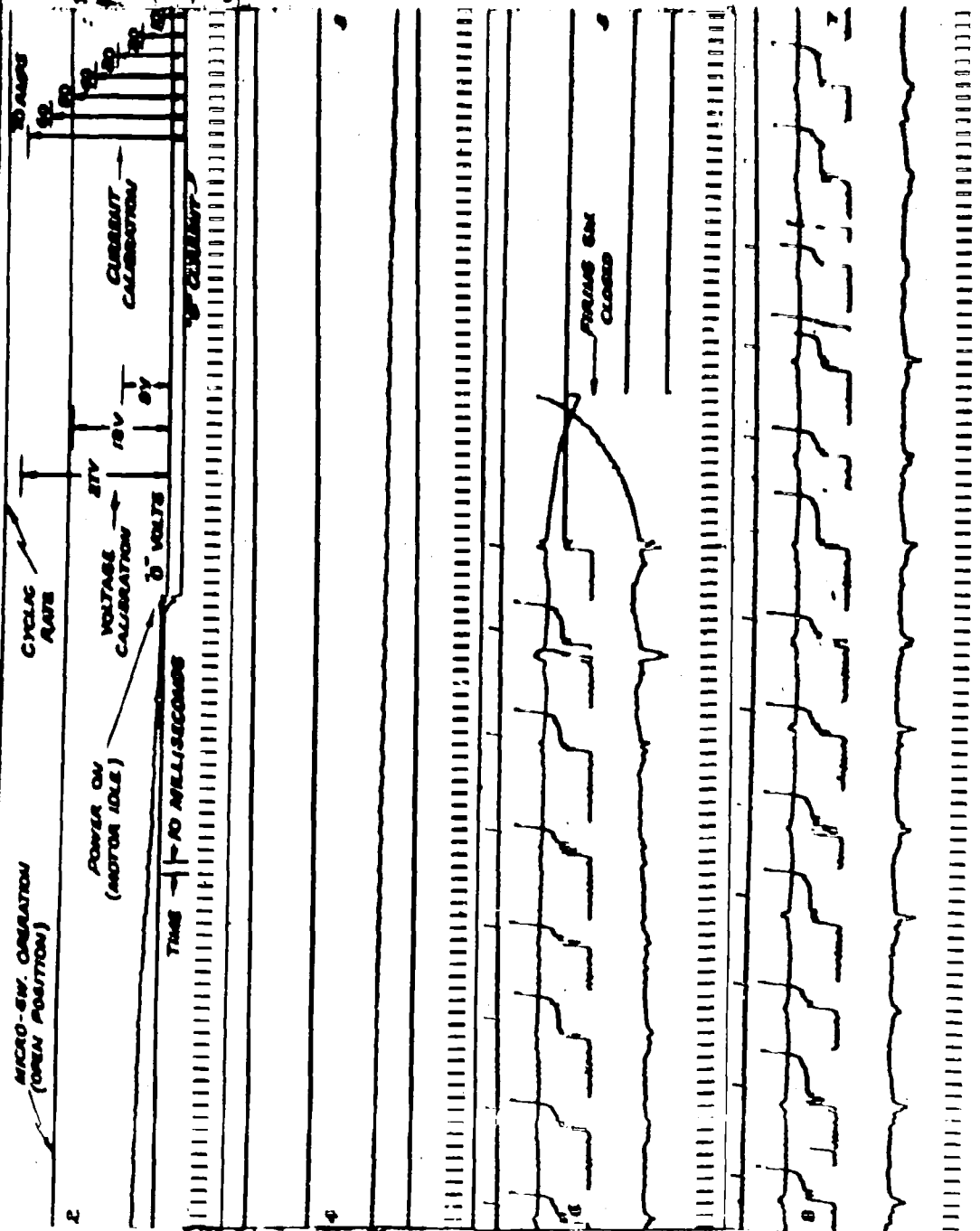


UNCLASSIFIED

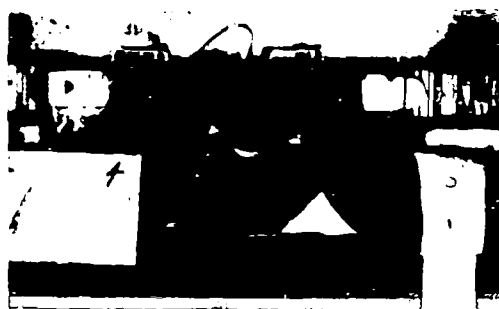
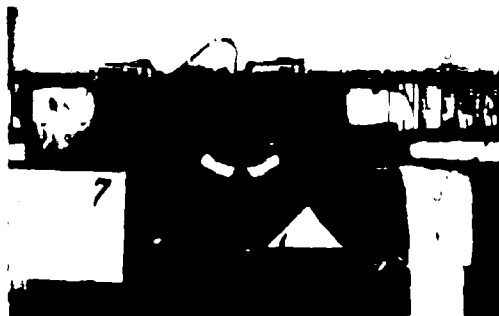
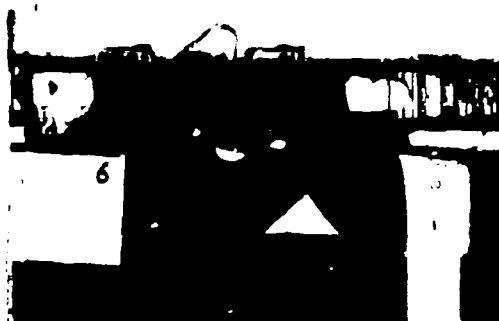
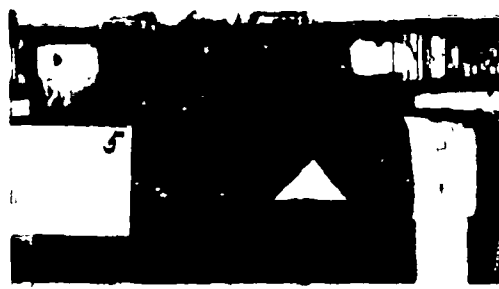
MPD 40164

Harvey Assist Feeder Mechanism: (See page 2 for details)  
 Feed Mechanism: (See page 3 for details)  
 Burst and (known.)

Figure 6



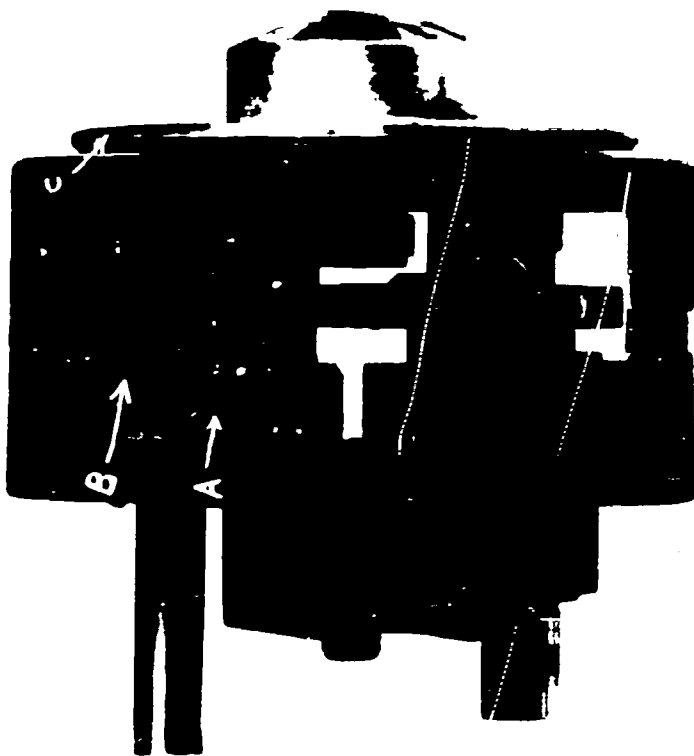
UNCLASSIFIED

[illegible]

NP9 48726

Gear reduction and clutch assembly, anti-roll-back fuel tank, anti-roll-back clutch plate.

Figure 7



RESTRICTED

NIG REPORT NO. 1208

20mm Ammunition Assist Feeder  
Developed by Harvey Machine Company

-----

DISTRIBUTION

Bureau of Ordnance:

Ad3	1
Re8	1
Re8a	1
Mn8	1
Re2	2

Armed Services Technical Information Agency  
Document Service Center  
Knott Building  
Dayton 2, Ohio

5

Commanding General  
Aberdeen Proving Ground  
Aberdeen, Maryland  
Attn: Technical Information Section  
Development and Proof Services

1

Commander, Operational Development Force  
U. S. Atlantic Fleet, U. S. Naval Base  
Norfolk, Virginia

2

Bureau of Aeronautics  
Attn: Armament Section

2

NATC, Patuxent River, Maryland  
Attn: Armament Test

3

NAOTS, Chincoteague, Virginia

1

Air Materiel Command Liaison Officer  
Wing 3 Headquarters  
Aberdeen Proving Ground  
Aberdeen, Maryland

2

Naval Liaison Officer  
USAFPGC, Eglin Field, Florida

1

NADS, Johnsville, Pennsylvania

1

RESTRICTED

SECURITY INFORMATION

RESTRICTED

NPO REPORT NO. 1208

20mm Ammunition Assist Feeder  
Developed by Harvey Machine Company

-----

DISTRIBUTION (Continued)

U. S. Air Force AMC Engineering Field Office Room 1833, Main Navy Building Navy Department, Washington, D. C.	2
NOTS, Inyokern, California	1
NOTS, Inyokern, California Attn: Aviation Ordnance and Test Department	1
Watervliet Arsenal Watervliet, New York	1
Local:	
OV	1
OVG	1
OVE	1
File	1

UNCLASSIFIED

SECURITY INFORMATION

UNCLASSIFIED